AD-A158 418 SURVEY AND EXPOSITORY PAPERS ON TOPICS OF CURRENT INTEREST IN APPLIED MAT.. (U) SOCIETY FOR INDUSTRIAL AND APPLIED MATHEMATICS PHILADELPHIA P.. A K KAPILA 1/1

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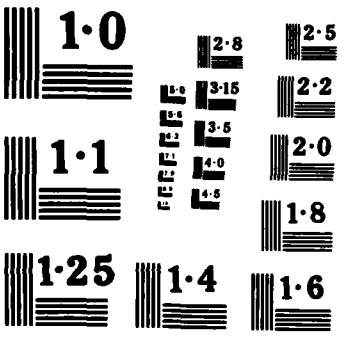

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: ARO 13926.1-MA	2. GOVT ACCESSION NO.: N/A	3. RECIPIENT'S CATALOG NUMBER: N/A
4. TITLE (and Subtitle): Survey and Expository Papers on Topics of Current Interest in Applied Mathematics		5. TYPE OF REPORT & PERIOD COVERED: Final Report 3/15/80 to 3/15/85
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): A. K. Kapila		8. CONTRACT OR GRANT NUMBER(s): DAAG29-80-C-0091
9. PERFORMING ORGANIZATION NAME AND ADDRESS: (Society for Industrial and Applied Mathematics) 117 South 17th St., Philadelphia, PA 19103-5085		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: N/A
11. CONTROLLING OFFICE NAME AND ADDRESS: U. S. Army Research Office, Post Office Box 12211, Research Triangle Park, NC 27709		12. REPORT DATE: 7/24/85
		13. NUMBER OF PAGES: 4
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report): Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

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18. SUPPLEMENTARY NOTES

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Survey and expository papers, linear-quadratic control, Whittaker Cardinal functions, nonlinear systems, singular perturbations in optimal control, partial differential equations, vector and parallel computers, queueing networks, random processes.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report lists the titles and abstracts of survey and expository papers published in SIAM Review under the ~~above~~ contract.

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ARO 13926.1-MA

SURVEY AND EXPOSITORY PAPERS ON TOPICS OF CURRENT INTEREST IN APPLIED MATHEMATICS

Final Report

For the period March 15, 1980 - March 15, 1985

ARO Contract No. DAAG29-80-C-0091

Society for Indsutrial and Applied Mathematics
117 South 17th Street
Philadelphia, PA 19103-5085

Prepared by A. K. Kapila
July 24, 1985

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Under this contract, the following papers were published in SIAM Review:

1. J. L. Casti, "The linear-guadratic control problem: Some recent results and outstanding problems", SIAM Review 22 (1980), pp. 459-483.

2. F. Stenger, "Numerical methods based on the Whittaker Cardinal, or Sinc functions", SIAM Review 23 (1981), pp. 165-224.

3. J. L. Casti, "Recent developments and future perspectives in nonlinear systems theory", SIAM Review 24 (1982), pp. 301-331.

4. P. V. Kokotovic, "Singular perturbations in optimal control", SIAM Review 26 (1984), pp. 501-550.

5. J. M. Ortega and R. G. Voigt, "Solution of partial differential equations on vector and parallel computers", SIAM Review 27 (1985), pp. 149-240.

6. R. L. Disney and D. Konig, "Queueing networks: a survey of their random processes", SIAM Review, in press.

Appendix I contains the abstracts of these papers, and Appendix II lists the total expenditure incurred.

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APPENDIX I.

List of Abstracts

1. J. L. Casti, "The linear-quadratic control problem: some recent results and outstanding problems", SIAM Review 22, (1980), 459-483.

   The classical linear-quadratic-Gaussian (LQG) problem from optimal control theory is surveyed with respect to recent developments in the following areas: singular control, state/control constraints, the LQG inverse problem, and algebraic/geometric structure. It is shown that a number of important results obtained during the past few years have substantially illuminated the global structure of the class of all LQG problems, as well as materially enhancing the capability of dealing with important practical aspects of LQG problem solutions. A number of outstanding research problems are also introduced.

2. F. Stenger, "Numerical methods based on Whittaker Cardinal, or Sinc functions", SIAM Review 23, (1981), 165-224.

   This paper summarizes the results known to date for using sinc functions composed with other functions as bases for approximations in numerical analysis. Described in this paper are methods of interpolation and approximation of functions and their derivatives, quadrature, the approximate evaluation of transforms (Hilbert, Fourier, Laplace, Hankel and Mellin) and the approximate solution of differential and integral equations. The methods have many advantages over classical methods which use polynomials as bases. In addition, all of the methods converge at an optimal rate, if singularities on the boundary of approximation are ignored.

3. J. L. Casti, "Recent developments and future perspectives in nonlinear system theory", SIAM Review 24, (1982), 301-331.

   Results on controllability, observability and realization of input/output data for linear systems are well-known and extensively covered in a variety of books and papers. What is not so well known is that substantial progress has been made in recent years on providing similarly detailed results for nonlinear processes. This paper represents a survey of the most interesting work on nonlinear systems, together with a discussion of the major obstacles standing in the way of a comprehensive theory of nonlinear systems.

4. P. V. Kokotovic, "Singular perturbations in optimal control", SIAM Review 26, (1984), 501-550.

   Singular perturbations, a traditional tool of fluid dynamics, has recently entered the field of modelling, analysis, and design of control systems. This paper studies some typical control problems in the framework of singular perturbations. The problems are drawn from the areas of optimal trajectories, composite feedback control of nonlinear systems and highgain feedback systems. A special emphasis is placed on the issue of modelling and scaling, and typical difficulties in applications are discussed.

5. J. M. Ortega and R. G. Voigt, "Solution of partial differential equations on vector and parallel computers", SIAM Review 27 (1985), 149-240.

In this paper we review the present status of numerical methods for partial differential equations on vector and parrallel computers. A discussion of the relevant aspects of these computers and a brief review of their development is included, with particular attention paid to those characteristics that influence algorithm selection. Both direct and iterative methods are given for elliptic equations as well as explict and implicit methods for initial-boundary value problems. The intent is to point out attractive methods as well as areas where this class of computer architecture cannot be fully utilized because of either hardware restrictions or the lack of adequate algorithms. A brief discussion of application areas utilizing these computers is included.

6. R. L. Disney and D. Konig, "Queueing networks: a survey of their random processes", SIAM Review, in press.

In this paper we review three topics in queueing network theory: queue length processes, sojourn times, and flow processes. In the discussion of the queue length processes we present results for the continuous-time process and several embedded processes. Then we compare continuous-time processes with embedded processes. In considerable generality we present results for mean sojourn times and discuss the distributions of sojourn times. In the discussion of flow processes we present results for various queueing systems. Our bibliography of over 300 references, while not exhaustive, does cover the major papers for the topics considered.

APPENDIX II.

Details of Expenditure

Author(s)	Article	No. of Pages	Page Charge + Honorarium
Casti, J.L.	"The Linear-quadratic Control Problem: Some Recent Results and Outstanding Problems"	27 x $48.00	$1296.00 + $1000.00
Stenger, F.	"Numberical Methods Based on Whittaker Cardinal, or Sinc Functions"	60 x $48.00	$2880.00 + $1000.00
Casti, J.L.	"Recent Developments and Future Perspectives in Nonlinear System Theory"	31 x $48.00	$1488.00 + $1000.00
Kokotovic, P.V.	"Singular Perturbations in Optimal Control"	50 x $48.00	$2400.00 + $1000.00
Disney, R.	"Queueing Networks: A Survey of Their Random Processes"	66 x $48.00	$3168.00 + $1000.00
Ortega, J.M., Voigt, R. G.	"Solution of Partial Differential Equations on Vector and Parallel Computers"	85 x $48.00	$4080.00 + $1000.00
			$15312.00 + $6000.00

Unexpended balance of $7888.00

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